



THE FIRST RECORD OF *TROCHULUS BIELZI* (E. A. BIELZ, 1860) IN HUNGARY (ZEMPLÉN MOUNTAINS), WITH NOTES ON THE ANATOMY OF SOME *TROCHULUS* SPECIES (GASTROPODA: PULMONATA: HYGROMIIDAE)

ROLAND FARKAS¹, BARNA PÁLL-GERGELY²

¹Aggtelek National Park Directorate, Tengerszem oldal 1, H-3758 Jósvald, Hungary
(e-mail: farkasro@yahoo.com); corresponding author

²Department of Biology, Shinshu University, Matsumoto 390-8621, Japan (e-mail: pallgergely2@gmail.com)

ABSTRACT: The first record of *Trochulus bielzi* (E. A. Bielz) is reported from Hungary (Zemplén Mts, Nyíri-patak valley near Füzérkomlós). The anatomy and two shells of *T. bielzi* are illustrated, and the new locality is shown on a map. Exact measurements of epiphallus, flagellum, penis and vagina of *T. bielzi* from the new locality and from Romania, and of some other similar *Trochulus* species (*unidentatus* (Draparnaud), *filicinus* (L. Pfeiffer), *bakowskii* (Poliński)), as well as length proportions of these organs are given. Some of the differences in the length ratios of the genital organs may prove useful when identifying members of *Trochulus*.

KEY WORDS: terrestrial snails, ecology, anatomy, Carpathian distribution

INTRODUCTION

Trochulus bielzi (E. A. Bielz, 1860) is distributed in the Eastern Carpathian Mts (e.g. POLIŃSKI 1924, 1929, PROČKÓW 2009), where its range extends southwards to the Hargita Mts. The species is also found in the Transylvanian Western Carpathians, in the Apuseni Mts (SOÓS 1943, GROSSU 1983). In the north its distribution follows the Carpathian Chain, reaching Poland, Ukraine and Slovakia. In Poland the species is found only in the eastern parts of the Beskidy Mts (POLIŃSKI 1929, WIKTOR 2004). It is frequent in the Vihorlat in Slovakia (LOŽEK 1964, JURÍČKOVÁ et al. 2006), but west of this area *T. bielzi* has only few localities in the Slanské hills, Busov, Ondava hills (LOŽEK 1964, BRABENEC 1974, LISICKÝ 1991, LUČIVJANSKÁ & ŠTEFFEK 1991, ŠTEFFEK unpublished) and in the environs of Prešov (LISICKÝ 1991). *T. bielzi* prefers dense

vegetation in mesic forests at lower mountain altitudes, usually not higher than 600–700 m a.s.l. (PROČKÓW 2009).

Anatomical characters play an important role in the classification within the family Hygromiidae. In some cases the genital features are more important than the shell characters. In several taxa, shells are insufficient for identification (HAUSDORF 2000, 2003, FEHÉR et al. 2009). Exact measurements and proportions of the genitalia are widely used in the family (e.g. HAUSDORF 2000, 2003). We have no knowledge on published records of exact measurements of the genital organs of any species of *Trochulus* s. l. This paper reports on the first locality of *T. bielzi* in Hungary, and on the genital structure of some closely related species.

MATERIAL AND METHODS

Specimens of *Trochulus* were collected by hand sampling. Samples of topsoil and leaf litter were taken to obtain the inventory of the accompanying fauna.

The samples (altogether 7 litres) were taken from different sites in the valley of the stream Nyíri-patak (Zemplén Mts).

The locality data of the examined *Trochulus* are the following (the sample numbers correspond to those in Table 1):

T. bakowskii (Poliński, 1924) (1): Poland, Bieszczady Mts, Ustrzyki Górne, leg. M. PROČKÓW; (2): Poland, Bieszczady Mts, Terebowiec Valley, leg. M. PROČKÓW; (3): Poland, Bieszczady Mts, Wetlina, leg. M. PROČKÓW;

T. bielzi (E. A. Bielz, 1860) (1): Hungary, northern part of the Zemplén Mts, Nyíri-patak stream valley, near Füzérkomlós, leg. R. FARKAS, 01.06.2009; (2): Romania, Jud. Harghita, vegetation along the road near Lacu Roşu (Red Lake), 46°47'34.4"N, 25°47'55.4"E, leg. B. PÁLL-GERGELY, 25.05.2011; (3): Romania, Jud. Suceava, Munții Rarău, south of Câmpulung Moldovenesc, along the stream, 1,300 m, leg. B. PÁLL-GERGELY, 25.06.2005;

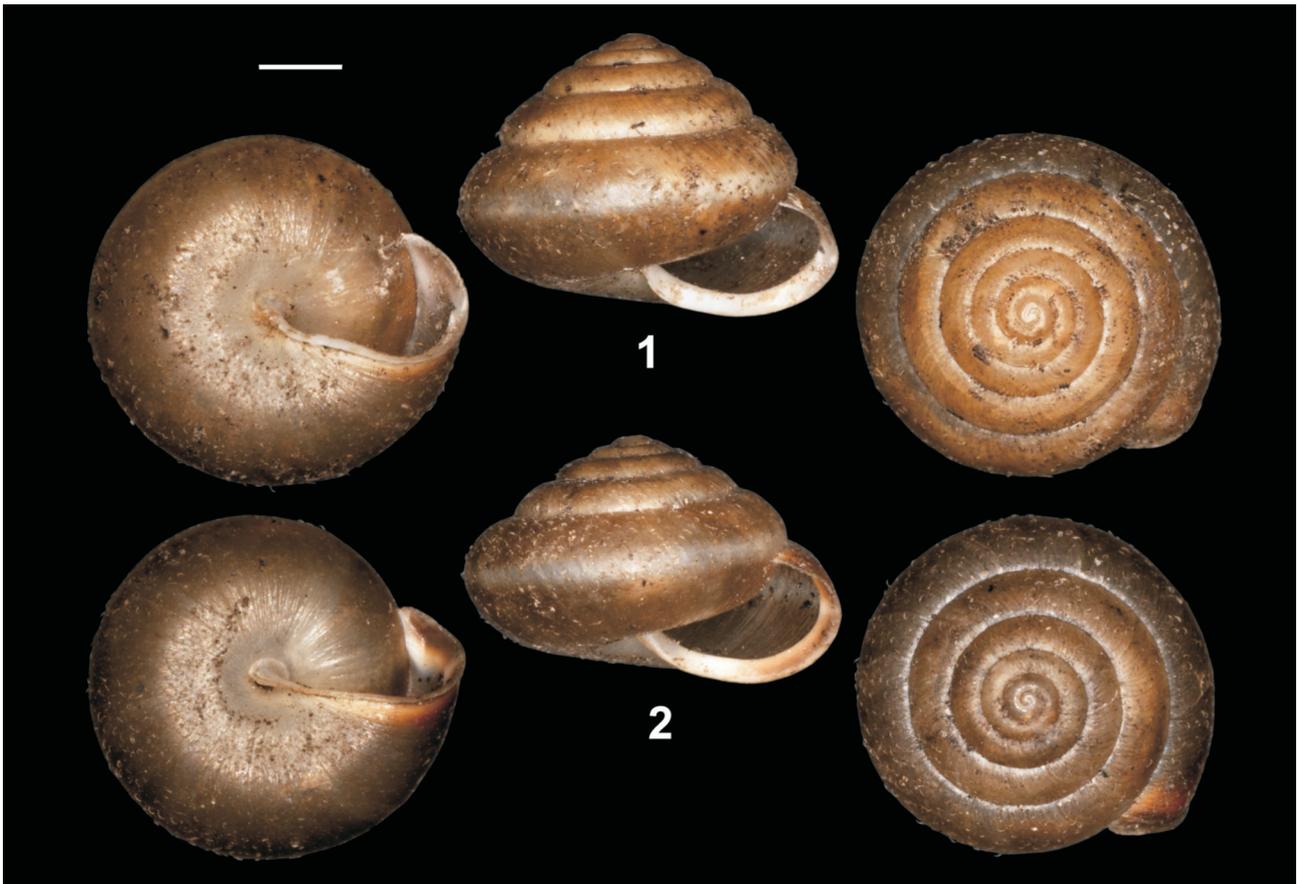
T. filicinus (L. Pfeiffer, 1841): Hungary, Mecsek Mts, Orfű, Szuadó valley, leg. B. PÁLL-GERGELY, May 2010;

T. unidentatus (Draparnaud, 1805) (1): Hungary, Szigetköz region, Lóvári-forest between Mosonmagyaróvár and Bezenye, leg. B. PÁLL-GERGELY, May 2010; (2): Hungary, Zemplén Mts, Nagy-Milic, leg. R. FARKAS, 30.09.2010.

The animals were preserved in 70% ethanol for anatomical study. Their genital organs (epiphallus, flagellum, penis, vagina) were measured under stereomicroscope with the accuracy of 0.1 mm (Table 1). The vagina was measured to the base of the dart sacs. All measurements were taken from adult specimens. Formation of apertural lip of the live Hungarian *T. bielzi* had just begun, therefore they were interpreted as subadults. The collected material is kept in the

Table 1. Measurements and proportions of selected organs of the genital structure (in mm) of *Trochulus* spp. For numbers following the species name see 'Material and Methods'. Abbreviations: e – epiphallus, f – flagellum, p – penis, v – vagina.

Specimens (locality)	Measurements				Ratios		
	p	e	f	v	e/p	p/v	e/f
<i>T. bakowskii</i> (1)	2.2	2.8	3.0	4.5	1.3	0.5	0.9
<i>T. bakowskii</i> (1)	2.2	2.8	3.0	3.5	1.3	0.6	0.9
<i>T. bakowskii</i> (1)	1.7	2.3	3.0	3.7	1.3	0.5	0.8
<i>T. bakowskii</i> (2)	1.7	2.7	2.7	4.1	1.6	0.4	1.0
<i>T. bakowskii</i> (2)	3.0	3.8	3.8	3.9	1.3	0.8	1.0
<i>T. bakowskii</i> (2)	2.8	3.0	3.7	4.8	1.1	0.6	0.8
<i>T. bakowskii</i> (3)	2.8	3.1	3.7	3.3	1.1	0.8	0.9
<i>T. bakowskii</i> (3)	1.9	3.2	3.3	3.9	1.7	0.5	1.0
<i>T. bielzi</i> (1)	4	3.1	4	2.3	0.8	1.7	0.8
<i>T. bielzi</i> (1)	3.5	4	4.3	2.7	1.1	1.3	0.9
<i>T. bielzi</i> (1)	4	4	4.5	3.5	1.0	1.1	0.9
<i>T. bielzi</i> (2)	5.3	5.3	6.8	3	1.0	1.8	0.8
<i>T. bielzi</i> (2)	6.8	5	7.5	3	0.7	2.3	0.7
<i>T. bielzi</i> (3)	4.5	5	5	1.7	1.1	2.6	1.0
<i>T. filicinus</i>	6.5	6	8.6	7.5	0.9	0.9	0.7
<i>T. filicinus</i>	5.5	4.8	7.4	7	0.9	0.8	0.6
<i>T. filicinus</i>	5.8	3.8	6.8	6.2	0.7	0.9	0.6
<i>T. filicinus</i>	5.8	5.1	9.5	6.2	0.9	0.9	0.5
<i>T. unidentatus</i> (1)	5	5	3.6	5.7	1.0	0.9	1.4
<i>T. unidentatus</i> (1)	6.5	5.7	4.2	6.2	0.9	1.0	1.4
<i>T. unidentatus</i> (1)	5	5.3	2.8	4.8	1.1	1.0	1.9
<i>T. unidentatus</i> (2)	6	5.5	3.4	6.5	0.9	0.9	1.6
<i>T. unidentatus</i> (2)	4.5	4.8	3.2	5.5	1.1	0.8	1.5
<i>T. unidentatus</i> (2)	4.2	4.8	2.5	5.5	1.1	0.8	1.9
<i>T. unidentatus</i> (2)	4.3	4.8	2.8	5.1	1.1	0.8	1.7



Figs 1, 2. Shells of *Trochulus bielzi*. Zemplén Mts, Füzérkomlós: valley of Nyíri-patak stream. Scale bar 1 mm

authors' private collections, and some specimens are deposited in the collections of the Hungarian Natural History Museum Budapest (HNHM 97481/1 shell) and in the Naturhistorisches Museum Wien (Austria)

(NHMW 108115/1 shell). The nomenclature of *Trochulus* species follows PROČKÓW (2009), whereas in other cases we followed www.faunaeur.org.

RESULTS

THE NEW LOCALITY OF *TROCHULUS BIELZI*

The first Hungarian population of *T. bielzi* was discovered on June 3, 2009, in the northern part of the Zemplén Mts (for the shells see Figs 1 and 2). The new locality (Fig. 3) administratively belongs to Füzérkomlós, but is located near Hollóháza, a few hundred meters south of the village.

The population was found along the NW-SE running valley of the stream Nyíri-patak. The patch where the snail occurs is approximately 800 meters in length. The upper end of the area is situated at 290 m a.s.l., the bottom end is 60 meters in width and situated at 250 m a.s.l. The coordinates of the centre of the patch are 48°31'37"N, 21°26'01"E. In the upper part of the patch the stream runs through a hornbeam-oak (*Carpinus-Quercus*) forest, which gradually changes to an alder (*Alnus*) gallery forest. *T. bielzi* was found in both vegetation types. Live specimens could

be sampled from the vegetation and from dead leaves along the valley bottom. In the tall-forb vegetation of the hornbeam-oak forest, stinging nettle (*Urtica*

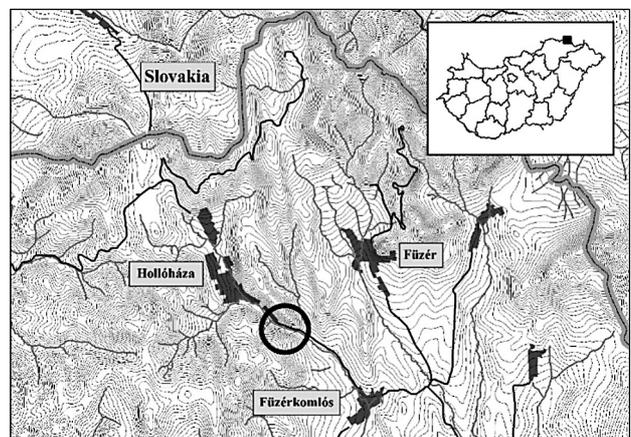


Fig. 3. New locality of *Trochulus bielzi* in Hungary

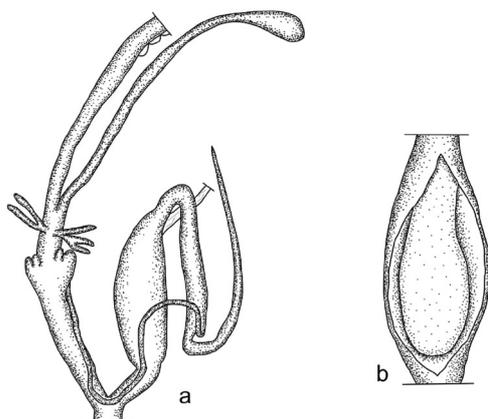


Fig. 4. Genitalia of *Trochulus bielzi*. Zemplén Mts, Füzérkomlós: valley of Nyíri-patak stream: a – general view of the genitalia, b – penial papilla

Table 2. Proportions of measurements of different genital structures of *Trochulus* species. For abbreviations see Table 1

Species	e/p	p/v	e/f
<i>T. bakowskii</i>	1.1–1.7	0.4–0.8	0.8–1.0
<i>T. bielzi</i>	0.7–1.1	1.1–2.6	0.7–1.0
<i>T. filicinus</i>	0.7–0.9	0.8–0.9	0.5–0.7
<i>T. unidentatus</i>	0.9–1.1	0.8–0.9	1.4–1.9

dioica) was the dominant species. In the alder gallery forest, kingcup (*Caltha palustris*), common butterbur (*Petasites hybridus*) and young black elder bushes (*Sambucus nigra*) were abundant; common hop (*Humulus lupulus*) overgrew the tree trunks and the ground. The ground was covered by thick leaf litter, especially some distance from the stream. *T. bielzi* was

DISCUSSION

DISTRIBUTION AND CONSERVATION

T. bielzi is reported here as new to the Hungarian fauna. The nearest known record is the Slanské hills in Slovakia, approximately 25 km from the new site. The edge of the Zemplén Landscape Protection Area covers only 15% of the locality. The major part of the population inhabits the base of the valley, exposed to intense floods which can change the habitat considerably and flush away the snails. Besides these natural hazards, the habitat is subject to significant human impact: considerable amounts of sewage, illegal garbage disposal from the nearby road and damage caused during the road maintenance.

The species is protected in Poland but not yet protected in Slovakia and Hungary. According to the lat-

est IUCN assessment (FEHÉR 2011), the status of *T. bielzi* is of Least Concern. Nevertheless, it is worth mentioning that the species is locally important in Hungary because only one locality is known, and it indicates Carpathian biogeographical influence in the Zemplén Mts.

not very abundant in the new locality; we found nine empty shells and two live specimens in our 7-litre soil sample, and three living specimens by hand sampling. Besides *T. bielzi*, 25 land snail species were found in the new site. Many of them have a characteristic Carpathian distribution (the list follows alphabetical order with nomenclature after FALKNER et al. 2001): *Aegopinella minor* (Stabile, 1864), *Ae. pura* (Alder, 1830), *Alinda biplicata* (Montagu, 1803), *Carychium minimum* O. F. Müller, 1774, *Ceciloides acicula* (O. F. Müller, 1774), *Cellariopsis deubeli* (A. J. Wagner, 1914), *Cochlicopa lubrica* (O. F. Müller, 1774), *Columella edentula* (Draparnaud, 1805), *Discus perspectivus* (Megerle von Mühlfeld, 1818), *Euomphalia strigella* (Draparnaud, 1801), *Faustina faustina* (Rossmässler, 1835), *Isognomostoma isognomostomos* (Schröter, 1784), *Laciniaria plicata* (Draparnaud, 1801), *Monachoides incarnatus* (O. F. Müller, 1774), *M. vicinus* (Rossmässler, 1842), *Morlina glabra striaria* (Westerlund, 1881), *Semilimax semilimax* (J. Férussac, 1802), *Succinea putris* (Linnaeus, 1758), *Succinella oblonga* (Draparnaud, 1801), *Trochulus lubomirskii* (Ślósarski, 1881), *Vertigo pusilla* (O. F. Müller, 1774), *V. pygmaea* (Draparnaud, 1801), *Vestia gulo* (E. A. Bielz, 1859), *Vitrea diaphana* (S. Studer, 1820) and *Vitrina pellucida* (O. F. Müller, 1774).

ANATOMY OF TROCHULUS

The measurements and ratios of the selected genital organs in all the examined specimens are shown in Table 1. Table 2 shows the overall ratios in the four examined members of *Trochulus*. Figure 4 shows the genital anatomy of *T. bielzi* from the new locality. The species we dissected differed anatomically mainly in the proportions of their genitalia; *T. unidentatus* however was unique because of its elongated inner dart sacs.

ANATOMY

The epiphallus/penis ratio (Table 2) does not vary much between the species. The penis/vagina and epiphallus/flagellum ratios, on the other hand, can be highly significant during identification and characterisation of the species. *T. bielzi* seems to have a greater penis/vagina ratio, compared to the other species examined. PROČKÓW (2009) reports a long (6



mm) vagina in *T. bielzi*, but her measurements refer to the total length of the vagina, including the dart sac region. The low-situated dart sacs may provide a good distinctive character when the shell morphology alone is insufficient for identification. Anatomically, the Romanian populations of *T. bielzi* did not differ considerably from the Hungarian specimens. Therefore, in agreement with PROČKÓW (2009), we do not suggest the use of the subspecific name *T. bielzi euconus* (Westerlund, 1890) for the Northern Carpathian populations. The epiphallus/flagellum ratio does not seem to be a good distinguishing feature between the two similar species, *T. bielzi* and *T.*

bakowskii. In *T. filicinus* and *T. unidentatus* we found very different epiphallus/flagellum ratios: in *filicinus* low, in *unidentatus* very high. Further studies are necessary to verify the significance of our data.

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